

AD _____

GRANT NUMBER DAMD17-94-J-4129

TITLE: Identification of BRCA1 and 2 Other Tumor Suppressor Genes
on Chromosome 17 Through Positional Cloning

PRINCIPAL INVESTIGATOR: Raymond L. White, Ph.D.

CONTRACTING ORGANIZATION: University of Utah
Salt Lake City, Utah 84112

REPORT DATE: July 1998

TYPE OF REPORT: Annual

PREPARED FOR: Commander
U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for Public Release;
Distribution Unlimited

The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision unless so designated by other documentation.

DTIC QUALITY INSPECTED 4

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)

2. REPORT DATE

July 1998

3. REPORT TYPE AND DATES COVERED

Annual (1 Jul 97 - 30 Jun 98)

4. TITLE AND SUBTITLE

Identification of BRCA1 and 2 Other Tumor Suppressor Genes on Chromosome 17 Through Positional Cloning

5. FUNDING NUMBERS

DAMD17-94-J-4129

6. AUTHOR(S)

Raymond L. White, Ph.D.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

University of Utah
Salt Lake City, Utah 84112

8. PERFORMING ORGANIZATION
REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

10. SPONSORING / MONITORING
AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

19981210 087

12a. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for Public Release; Distribution Unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

During the past year we have successfully implemented the Microarray Spotting and Scanning techniques described in our revised statement of work (SOW). This includes development of robust fluorescent labeling and hybridization protocols as well as the preparation and testing of over 23,000 minimally redundant cDNA target samples for deposition on the microarray slides. As proposed, we have compared expression profiles from several distinct breast cell lines. By scanning 2400 clones on our first slide array we have discovered 29 genes and ESTs that reveal altered expression patterns as a consequence of conditionally expressed dominant-negative β -catenin in primary breast cells. Once the full length sequence of each of the differentially regulated genes has been ascertained and prioritized, they will be introduced into appropriate cell lines to study their effect on cell morphology and gene regulation. During the past year we have also had the opportunity to compare and select the retroviral LINX vector as our conditional expression system. Experiments have also been initiated to observe regulatory affects of E6 and E7 transformed breast cells grown in Matrigel and comparisons of a larger collection of primary cells and established cell-lines is being designed.

14. SUBJECT TERMS

Breast Cancer

15. NUMBER OF PAGES

27

16. PRICE CODE

17. SECURITY CLASSIFICATION
OF REPORT

Unclassified

18. SECURITY CLASSIFICATION OF THIS
PAGE

Unclassified

19. SECURITY CLASSIFICATION
OF ABSTRACT

Unclassified

20. LIMITATION OF ABSTRACT

Unlimited

FOREWORD

Opinions, interpretations, conclusions and recommendations are those of the author and are not necessarily endorsed by the U.S. Army.

____ Where copyrighted material is quoted, permission has been obtained to use such material.

____ Where material from documents designated for limited distribution is quoted, permission has been obtained to use the material.

____ Citations of commercial organizations and trade names in this report do not constitute an official Department of Army endorsement or approval of the products or services of these organizations.

____ In conducting research using animals, the investigator(s) adhered to the "Guide for the Care and Use of Laboratory Animals," prepared by the Committee on Care and use of Laboratory Animals of the Institute of Laboratory Resources, national Research Council (NIH Publication No. 86-23, Revised 1985).

 PW _X For the protection of human subjects, the investigator(s) adhered to policies of applicable Federal Law 45 CFR 46.

 PW _X In conducting research utilizing recombinant DNA technology, the investigator(s) adhered to current guidelines promulgated by the National Institutes of Health.

 PW _X In the conduct of research utilizing recombinant DNA, the investigator(s) adhered to the NIH Guidelines for Research Involving Recombinant DNA Molecules.

____ In the conduct of research involving hazardous organisms, the investigator(s) adhered to the CDC-NIH Guide for Biosafety in Microbiological and Biomedical Laboratories.

 PW *W. H. H. H.* 7/30/98
PI - Signature Date

Table of Contents

Front Cover.....	1
Report Documentation Page.....	2
Foreword.....	3
Table of Contents.....	4
Introduction.....	5
Body.....	6
Conclusions.....	11
References.....	12
Appendix.....	13
List of Salaried Personnel.....	27

Introduction

The overall goal of our project is to identify genes involved with the development and progression of breast cancer. This goal has remained unchanged since the start of the project, but the discovery of BRCA1 in 1994 (1) together with technological advances in gene expression profiling (2) has influenced our strategy to achieve this goal. In the early part of the project our search for tumor suppressor genes was directed by genetic or LOH mapping strategies followed by positional cloning of candidate genes. This general approach is still extensively used in many laboratories, but is very labor intensive by nature. Apart from its primary objective of identifying a single cancer gene, this strategy contributes no additional observations relevant to carcinogenesis during the search process itself. A different and much broader strategy for identifying *any* kind of gene involved in tumor formation and progression, which is not dependent on prior knowledge of location, employs genetic profiling using high density microarrays. Not only does this technique permit detection of the expression profiles of each of a large number of genes in parallel, but it potentially also provides a mechanistic view of how regulatory pathways are controlled. Our laboratory has gained access to this technology through a collaboration with Molecular Dynamics. This company has manufactured a small number of prototype microarray spotters and scanners for members of an early access program. As we proposed in our last report and in our revised statement of work, we have now focused our efforts entirely on microarray-based comparisons to identify breast cancer related genes. Once candidate genes have been identified they will be further characterized using conditional expression systems to assess changes in characteristics pertaining to morphology, growth rate altered expression patterns.

Body

During the past 12 months most of our efforts have been focused on the completion of Task 1 in our statement of work. As part of this effort it has been our primary goal to establish microarray analysis as a reliable and reproducible technology to compare gene expression profiles and identify differentially regulated genes. Work has been carried out in three areas a) development of fluorescent labeling and hybridization protocols, b) selection and establishment of a collection of target genes, and c) gene expression comparisons between several different breast cell lines. Each of these efforts contributes to aims a) and b) in Task 1 of our statement of work. While Task 1 has been accomplished we will continue to perform comparisons of gene expression mentioned in aim b) throughout this final year. Progress has also been made on Task 2 aim a), where we have determined that the LINX conditional expression system resulted in the largest and most reproducible induction of a test gene. Characterization of the biologic effects of genes conditionally expressed in breast cells as mentioned in Task 2 aim b), still remain to be performed because time has not yet allowed us to construct and introduce new candidate genes, identified using the microarrays, to study their biologic effects.

Selection and preparation of target cDNA clones.

A key reagent in microarray analysis is the collection of genes deposited on the array slide against which the levels of expression are measured and we originally proposed to establish an expanding collection of 1000 unique cDNA clones for this purpose. Initially we selected a collection of 773 cDNA clones based on their potential biologic involvement in carcinogenesis (a list of these clones is attached in appendix A). However, we rapidly expanded this collection and we currently have an inventory of more than 23,000 minimally redundant cDNA clones prepped and available for target deposition. The procedures we have implemented to process this large number of clones are divided into two steps. In the first of these steps we grow mini cultures of each clone in 96-well microtitre plates. Similarly, for plasmid purification we use a purification procedure that takes advantage of the 96-well format. Using the plasmid as template in a PCR reaction in conjunction with vector based primers we are able to successfully amplify more than 95% of all clones. Following gel analysis or colorimetric analysis of the PCR yield, the PCR products are purified, using the 96-well format, to eliminate unincorporated nucleotides, primers and salts.

Development of probe labeling and hybridization protocols.

One of the most critical factors for a successful microarray experiment is the preparation of fluorescently labeled first strand cDNA to probe the microarray. The Molecular Dynamics Microarray System allows for dual color hybridization and the two fluorescent dyes we used are Cy3 and Cy5 from AP-Biotech. The labeling procedure itself is a multi step procedure that involves extraction of total RNA, mRNA purification and first strand cDNA synthesis. The fluorescent dyes conjugated to dCTP are incorporated into the cDNA to generate the fluorescent hybridization probe. We have found that SuperScript II results in better probes than AMV and MMLV reverse transcriptase, probably because it lacks proofreading ability. A variety of hybridization formats have also been tested. The most critical features of a successful hybridization with a complex probe are to achieve and maintain high probe concentration during hybridization. To increase the probe concentration we have determined that the smallest practical hybridization volume is 20 μ l under a 22mm \times 60mm coverslip. Steps must also be taken to maintain proper salt concentrations in the hybridization buffer during incubation (i.e. eliminate evaporative effects). We have found that sealing the coverslip to the slide during hybridization leaves a fluorescent signature that affects the hybridization signal. In the procedure we currently employ the coverslip is not sealed, but the incubation takes place in a closed humidified chamber.

Comparison of three conditional expression vector systems.

To identify a conditional expression system we compared a dominant-negative β -catenin construct (N-terminal deletions, dN131 and dN151) in three different conditionally inducible/suppressible vectors, pRetro ON, pRetro OFF (Clontech) and LINX (Dr. Fred Gage). These vector DNAs were transfected into the Phoenix Amphotropic packaging cell line (Dr. Garry Nolan) and the resulting infectious viral particles were used to infect primary human mammary epithelial cells. After two weeks of drug selection in either 0.5 mg/ml Puromycin (for pRetro ON and pRetro OFF) or 100 mg/ml G418 (for LINX), cells were treated with or without 10ng/ml doxycycline (DOX) for 48 hours. Total cell extracts were subjected to Western analysis using anti-C-terminal β -catenin antibody (see figure 1). To demonstrate that induced dominant β -catenin is functional, cells were infected with LINX vector control and LINX with an inducible dominant β -catenin gene (dN131) and subsequently transiently transfected with luciferase reporter construct, TOP FLASH, containing

a LEF1 responsive element in its promoter (obtained from Dr. Hans Clevers). As shown in figure 2, the relative activity of the LEF1-reporter construct showed 2.5 fold increase in activity following induction of β -catenin. Based on these results we have selected the LINX for further experimentation.

Figure 1.

Conditionally inducible vectors.

To test the efficacy of the tetracycline regulated retroviral vector system, dominant-negative β -catenin genes were cloned into pRetro Off, pRetro On, and LINX. Following packaging, transfection into primary human mammary epithelial cells and two weeks of selection, total cell extracts were subjected to Western analysis using anti-C-terminal β -catenin antibody. As shown here, cells infected with pRetro ON construct did not induce dominant β -catenin at all. Cells infected with pRetro OFF induced dominant β -catenin in response to DOX removal, however the amount induced (shown as exogenous) were much less than that of endogenous protein. On the other hand, cells infected with LINX vector construct produced great response in both inducibility and amount.

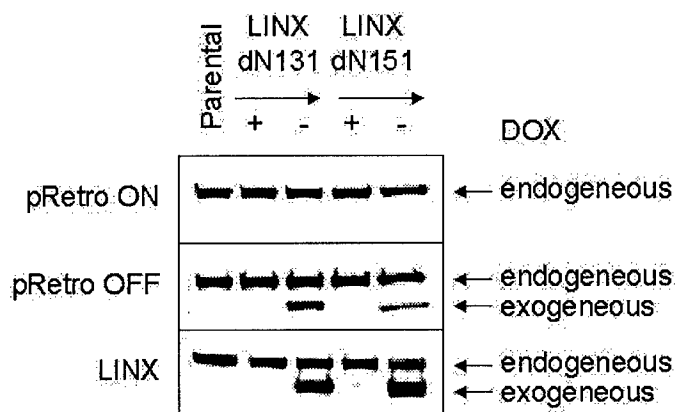
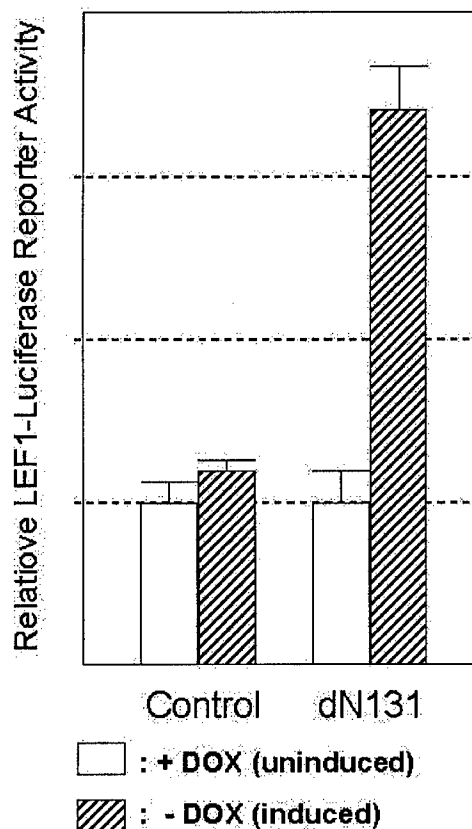


Figure 2

LEF1-Luciferase Reporter Assay.

Shown here are relative LEF1-reporter activities indicating that induced dominant β -catenin is in fact functional in regard to activating genes containing LEF1 element.



Analysis of primary breast cells with conditionally induced dominant β -catenin.

β -catenin has recently been shown to act as an oncogene in certain biologic models. To study the gene regulatory effects of the cancer pathway driven by wnt-1, APC or β -catenin in breast cells, human primary epithelial mammary cells were transfected with a conditionally suppressible dominant-negative β -catenin construct as mentioned above. Excessive stimulation of this pathway and certain types of mutations have been shown to involve the formation of a persistent transcriptionally active complex of β -catenin and LEF1 (3). mRNA from several different primary breast cultures, with and without induced β -catenin, was prepared and fluorescently labeled for dual color hybridization on microarray slides representative of 2400 unique cDNAs. A total of twenty-nine different genes have in repeated experiments been identified as differentially expressed and are listed in table 1.

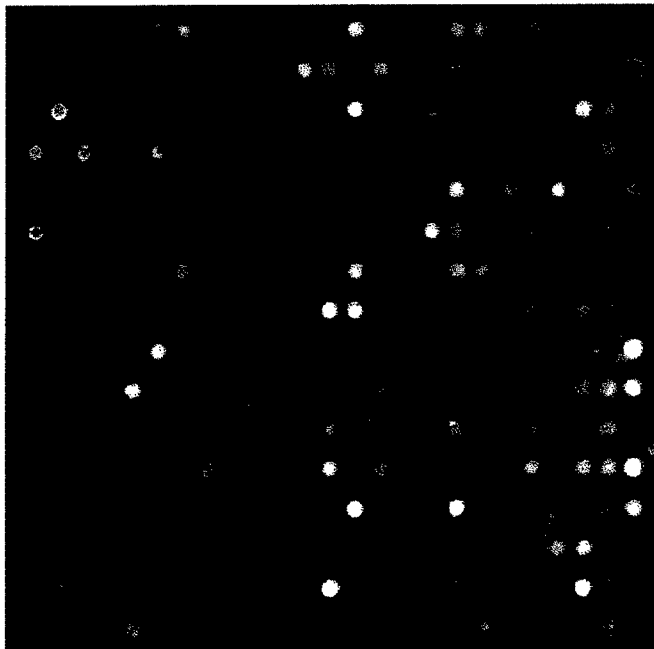


Figure 3.

Dual color microarray image.

This frame show a 25 \times 16 cDNA clone array from a slide representing 2400 unique cDNA clones co-hybridized with primary human mammary cells with induced (green) and uninduced (red) β -catenin. The right-most column contain several house-keeping genes and a control for labeling efficiency with Cy5 (the red spot in second row). Spots in the other columns represent individual genes. Spots with their color tone yellow represent genes of equal abundance in the two cell populations. Spots with predominantly green or red signal represent genes with differential expression levels between the two cell populations.

To confirm that the microarray observations are correct, Northern analysis of each differentially expressed gene is being undertaken. In figure 4 we show that Psoriasin, which displayed a 3-4 fold increase in abundance judging from the microarray analysis reveal similar differences in abundance when tested by Northern analysis.

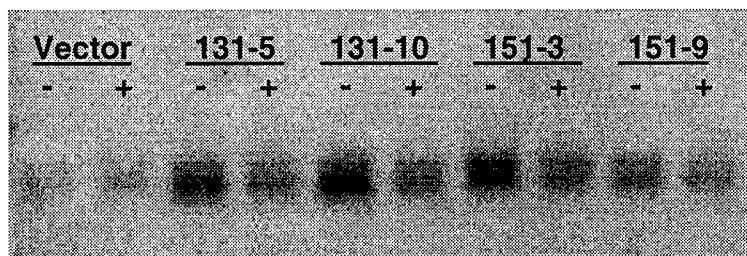
Table 1.

	Image ID	Clone definition
1	358433	Human retinoid X receptor-gamma mRNA, complete cds
2	295401	ESTs
3	1088345	S100 calcium-binding protein A7 (psoriasin 1)
4	276282	ESTs
5	269017	Human O-linked GlcNAc transferase mRNA, complete cds
6	545239	Neutrophil Gelatinase-Associated Lipocalin Precursor
7	882141	DNA G/T mismatch-binding protein
8	283063	MHC class II DQ-beta associated with DR2, DQw1 protein
9	156431	Ciliary neurotrophic factor receptor
10	770435	Transcription factor p65
11	700466	
12	277134	ESTs
13	275272	ESTs
14	273039	ESTs
15	283618	ESTs
16	23240	SM22-alpha homolog
17	627104	Human alpha-tubulin mRNA, complete cds
18	33934	ESTs
19	610187	Proteasome Component C9
20	592947	Autoantigen PM-SCL
21	46743	ESTs, Highly similar to RAS-related protein RAP-1B
22	23904	ESTs
23	264369	ESTs, Highly similar to GLUCOSYLTRANSFERASE ALG8
24	200531	ESTs
25	126783	ESTs
26	201891	ESTs
27	265684	ESTs
28	261971	Metallopeptidase 1 (33 kD)
29	129503	ESTs

The genes listed in this table showed 3× fold or more variation in expression levels in a comparison between primary human mammary cells, with and without induced β -catenin.

Figure 4.

This figure shows a Northern Blot of four different cell lines transfected with the LINX β -catenin construct and the vector control. In absence of Doxycilin (indicated by -) β -catenin is over-expressed resulting in a three fold up-regulation Psoriasin.



Analysis of primary breast cells transformed with E6 and E6/E7 and grown in matrigel.

The E6 and E7 genes derived from human papilloma virus-type 16 have been shown to bind to the tumor suppressor genes Rb and p53 (6), and more recent studies have shown that these genes can immortalize primary epithelial breast cells (7). We have established several primary epithelial mammary cell cultures with either E6 alone, E7 alone, or E6 and E7 together. As part of our experiment design we intend to compare these lines against one another, both when cultured on plastic and in matrigel. Because matrigel is developed from a biologic material it has been necessary to establish whether an expression signature inherent to the matrigel itself was present. Repeated experiments to determine the "expression" signature of matrigel have shown that under the conditions we apply no signature can be detected above background. In our next report we expect to present data from these experiments.

Conclusions

This past year has brought strong progress in both the biological and technological areas of the project. We have established microarray analysis as a reliable and efficient way of screening biologic specimens for expression profiles, we have procured and prepared a large inventory of minimally redundant expressed sequences, and we have identified a number of genes and ESTs characterized by altered expression patterns in several primary and immortalized breast cell model systems. We are currently in the process of establishing the full length sequence of these genes (ESTs) for the purpose of analyzing the biologic effects of these genes in primary breast cells. The transition our project has undergone has been worthwhile and we are confident that we will continue to develop a deeper insight into the formation and progression of breast cancer through the application of microarrays and determination of genetic expression profiles in normal and cancerous epithelial breast cells.

References

1. Y. Miki, et al., *Science* **266**, 66-71 (1994).
2. M. Schena, D. Shalon, R. W. Davis, P. O. Brown, *Science* **270**, 467-70 (1995).
3. E. Porfiri, et al., *Oncogene* **15**, 2833-9 (1997).
4. V. M. Weaver, et al., *J Cell Biol* **137**, 231-45 (1997).
5. V. M. Weaver, A. H. Fischer, O. W. Peterson, M. J. Bissell, *Biochem Cell Biol* **74**, 833-51 (1996).

Appendix

Table 1: List of 773 selected cDNA clones

Clone number	Gene Name	IMAGE ID
1	Apoptosis (APO-1) antigen 1	151767
2	B cell lymphoma protein 2	147002
3	Human Bc1-2 binding component 6 (bbc6) mRNA	684168
4	Human Bc1-2 related (Bf1-1) mRNA	686515
5	Apoptosis regulator BCL-X	46778
6	Caspase-1	120106
7	Caspase-3 (CPP32)	49729
8	Caspase-4 (Ich-2)	126322
9	Caspase-6 alpha (Mch2)	323500
10	Caspase-7 (Mch3)	221170
11	Caspase-9 (ICE-LAP6)	417440
12	Caspase-10 (Mch4)	240836
13	Defender against cell death 1	683752
14	Human IAP homolog B (MIHB) mRNA	712036
15	Human IAP homolog C (MIHC) mRNA	129632
16	ESTs, highly similar to apoptosis inhibitor IAP	120957
17	Human TRAF-interacting protein I-TRAF mRNA	242814
18	Human TNF-related apoptosis inducing ligand TRAIL mRNA	134175
19	Human tumor necrosis factor type 2 receptor associated protein (TRAP3) mRNA	526070
20	Cadherin 2, N-cadherin (neuronal)	325182
21	Cadherin 3 (P-cadherin)	346234
22	Cadherin 4	328330
23	Cadherin 5, VE-cadherin (vascular epithelium)	151104
24	Cadherin 8	21908
25	Cadherin 11 (OB-cadherin)	310129
26	Human connexin 26 (GJB2)	682359
27	Gap junction protein, beta 1, 32kD	108702
28	Gap junction protein, alpha 4, 37kD (connexin 37)	152947
29	Human cytoplasmic dynein light chain 1	965824
30	Hexabrachion (tenascin C, cytactin)	484707
31	Integrin, alpha 1 (CD49B, alpha 2 subunit of VLA-2 receptor)	687871
32	Integrin, alpha 2b (platelet glycoprotein IIb of IIB/IIIa complex, antigen CD41B)	758863
33	Integrin alpha-3 subunit	44280
34	Integrin, alpha 4 (antigen CD49D, alpha 4 subunit of VLA-4 receptor)	235135
35	Integrin, alpha 5 (fibronectin receptor, alpha polypeptide)	115952
36	Integrin, alpha 6	47271
37	Integrin, alpha 7B	628743
38	Integrin, alpha 9	120157
39	Integrin, alpha E	234699
40	Integrin, alpha L	684375
41	Integrin, alpha M	754406
42	Integrin, alpha V	469969
43	Integrin, alpha X	684777
44	Integrin, beta 1	565368
45	Integrin, beta 2	187822
46	Integrin, beta 3	251046
47	Integrin beta-4 subunit	153737
48	Integrin beta-5 subunit	202074
49	Integrin, beta 8	340644
50	Selectin E	186132
51	Selectin L	416087
52	Selectin P	108284

53	ESTs, Highly similar to sodium/hydrogen exchanger 3	127856
54	Solute carrier family 9, isoform 1	471728
55	Syndecan 1	512226
56	Syndecan 2	26356
57	Syndecan 4	116196
58	Human ATPase, DNA-binding protein (HIP116) mRNA, 3' end	43951
59	DNA repair helicase ERCC3	161126
60	DNA-binding protein (SMBP2)	111272
61	Cell division cycle 25A	110647
62	M-Phase Inducer Phosphatase 2	48398
63	Cell division cycle 25C	415102
64	Cell division cycle 27	681991
65	Cell division cycle 42	48569
66	Human CDK inhibitor p19Ink4d mRNA	145503
67	Chromosome condensation 1	23710
68	Cyclin-dependent kinase inhibitor 1A (p21, Cip1)	152524
69	Human Cdk-inhibitor p57KIP2 (KIP2)	252465
70	Cell division cycle 2-like 1 (PITSLRE proteins)	589430
71	Cell division cycle 2, G1 to S and G2 to M	685425
72	Cyclin A	427857
73	Cyclin B1	531805
74	Human cyclin C (CCNC) gene	503756
75	Cyclin D1 (PRAD1; parathyroid adenomatosis 1)	967322
76	Cyclin D2	359412
77	Cyclin D3	155203
78	Cyclin E	357807
79	Cyclin F	206323
80	Homo sapiens cyclin G1 mRNA	35516
81	Cyclin H	984365
82	Proliferating cell nuclear antigen	110931
83	RecQ protein-like (DNA helicase Q1-like)	686724
84	Bloom syndrome	202575
85	ESTs, moderately similar to transcription initiation factor IIA alpha and beta chains	259637
86	X-Linked Helicase II	544668
87	Cyclin-dependent kinase 2	276282
88	Cyclin-dependent kinase 6	214572
89	Cyclin-dependent kinase 7 (homolog of Xenopus MO15 cdk-activating kinase)	232777
90	CDC28 protein kinase 1	427925
91	Retinoblastoma-like 1 (p107)	221928
92	Colony-stimulating factor 1	141500
93	Colony-stimulating factor 2	105485
94	Endothelin 1	549409
95	Endothelin 3	1019683
96	Epidermal growth factor receptor pathway substrate 15	265612
97	Fibroblast growth factor 1	39058
98	Fibroblast growth factor 2	323776
99	Fibroblast growth factor 7	365515
100	Hepatocyte growth factor	375833
101	Heregulin alpha	82292
102	Interleukin 1, beta	324655
103	Interleukin 1, beta, convertase	120106
104	Interleukin 1 receptor antagonist	346177
105	Interleukin 6 (B cell stimulatory factor 2)	310406
106	Interleukin 10	107480
107	Interleukin 6 (B cell stimulatory factor 2)	310406
108	Insulin-like growth factor 1 (somatomedin C)	274071
109	Insulin-like growth factor 2 (somatomedin A)	199138
110	Insulin-like growth factor binding protein 1 precursor	487015

111	Insulin-like growth factor binding protein 2	995482
112	Insulin-like growth factor binding protein 3 precursor	251589
113	Insulin-like growth factor-binding protein 4	153410
114	Insulin-like growth factor binding protein 5	48934
115	Insulin-like growth factor binding protein 6	52603
116	Leukemia inhibitory factor	153025
117	Lymphotoxin alpha (formerly tumor necrosis factor beta)	345232
118	Lymphotoxin-beta	712066
119	Macrophage stimulating 1	229815
120	Platelet-derived growth factor PDGF-A	954157
121	Platelet-derived growth factor beta polypeptide	145844
122	Transforming growth factor, alpha	325822
123	Transforming growth factor beta 1 precursor	136821
124	Human transforming growth factor-beta-2	269306
125	Latent transforming growth factor beta binding protein 1	512840
126	Latent transforming growth factor beta binding protein 2	156176
127	Homo sapiens mRNA for latent transforming growth factor-beta binding protein-4	154381
128	Human transforming growth factor-beta induced gene product (BIGH3)	85579
129	Vascular endothelial growth factor	47326
130	Vascular endothelial growth factor B	181724
131	Interleukin-1 Receptor, Type I Precursor	471564
132	Interleukin-1 Receptor, Type II Precursor	233583
133	Interleukin 6 receptor	80474
134	Interleukin-6 Receptor Beta Chain Precursor	263262
135	Interleukin 10 receptoe	757440
136	Interferon (alpha, beta and omega) receptor 2	123950
137	Interferon-Gamma Receptor Alpha Chain Precursor	365131
138	Human clone pSK1 interferon gamma receptor accessory factor-1 (AF-1) mRNA, complete cds	306555
139	Tumor necrosis factor receptor 2 (75kD)	71046
140	Homo sapiens TNF receptor associated factor 5 mRNA, partial cds	701645
141	Human TNF receptor associated factor 6 (TRAF6) mRNA, complete cds	110502
142	Homo sapiens TNF receptor-1 associated protein (TRADD) mRNA, 3' end of cds	1007417
143	Formyl peptide receptor 1	126313
144	V-kit Hardy-Zuckerman 4 feline sarcoma viral oncogene homolog	37621
145	Human oncostatin-M specific receptor beta subunit (OSMRB) mRNA, complete cds	241545
146	Leukemia inhibitory factor receptor	137437
147	Colony stimulating factor 1 receptor, formerly McDonough feline sarcoma viral (v-fms)	204653
148	Endothelin receptor type A	211565
149	Endothelin receptor type B	268444
150	Insulin-like growth factor 1 receptor	148379
151	Insulin-like growth factor 2 receptor	342968
152	Met proto-oncogene (hepatocyte growth factor receptor)	429062
153	Human soluble vascular endothelial cell growth factor receptor (sflt) mRNA, complete cds	47424
154	Fms-related tyrosine kinase 4	651143
155	Epidermal growth factor receptor	206694
156	ESTs, highly similar to epidermal growth factor receptor substrate substrate 15 (homo sapiens)	526315
157	Transforming growth factor, beta receptor II (70-80kD)	24858
158	Transforming growth factor, beta receptor III (betaglycan, 300kD)	110287
159	Platelet-derived growth factor receptor, alpha polypeptide	489395
160	Platelet-derived growth factor receptor, beta polypeptide	213598
161	Basic fibroblast growth factor (bFGF) receptor (shorter form)	146842
162	Fibroblast growth factor receptor 2	110387
163	Fibroblast growth factor receptor 4	364317
164	V-erb-a avian erythroblastic leukemia viral oncogene homolog-like 4	79829
165	Human cysteine-rich fibroblast growth factor receptor	182455
166	Colony stimulating factor 3 receptor (granulocyte)	134369
167	Nerve growth factor receptor	154790
168	Oxytocin receptor	326170

169	Platelet-activating factor acetylhydrolase 45 KD subunit	52682
170	Platelet activating factor receptor	60403
171	Tachykinin 2	784179
172	Transferrin receptor (p90, CD71)	33043
173	Transferrin	197428
174	Androgen receptor	1011443
175	Cellular retinoic acid-binding protein 2	321451
176	Cytochrome P450, subfamily XIA	122695
177	Cytochrome P450, subfamily XIX	246581
178	Cytochrome P450, subfamily XXI	489919
179	Estrogen receptor	725321
180	Human breast cancer, estrogen regulated LIV-1 protein	668243
181	Human estrogen receptor-related protein (hERRa)	927843
182	Glucocorticoid receptor	668391
183	H.sapiens mRNA for novel glucocorticoid receptor-associated protein	115926
184	Heat shock 27kD protein 1	503116
185	Heat shock 70 KD protein 1	265267
186	Human 90-kDa heat-shock protein gene, cDNA	587152
187	Hydroxy-delta-5-steroid dehydrogenase, 3 beta- and steroid delta-isomerase 1	471125
188	Corticosteroid 11-beta-dehydrogenase, isozyme 1	489404
189	Human 11 beta-hydroxysteroid dehydrogenase type II mRNA	128379
190	Estradiol 17 beta-dehydrogenase 1	504757
191	17 beta hydroxysteroid dehydrogenase, type 2	121091
192	Hydroxysteroid (17-beta) dehydrogenase 3	289662
193	ESTs, highly similar to peroxisome proliferator activated receptor gamma	511832
194	Human nuclear orphan receptor LXR-alpha mRNA	206757
195	Human mitogen induced nuclear orphan receptor (MINOR)	265321
196	Orphan receptor TR2	39602
197	H.sapiens mRNA for putative progesterone binding protein	52059
198	Human 54 kDa progesterone receptor-associated immunophilin FKBP54 mRNA	123727
199	Retinoic acid receptor beta-2	357374
200	Retinoic acid receptor, gamma 1	70383
201	Human 1.1 kb mRNA upregulated in retinoic acid treated HL-60 neutrophilic cells	501428
202	Retinoid X receptor, alpha	417218
203	Retinoic acid receptor RXR-beta	203518
204	Human retinoid X receptor-gamma mRNA	358433
205	Human silencing mediator of retinoid and thyroid hormone action (SMRT) mRNA	173038
206	Human steroid receptor coactivator (SRC-1) mRNA	665268
207	Steroid-5-alpha-reductase, alpha polypeptide 1	39158
208	Human sulfotransferase mRNA	417508
209	Orphan receptor TR4	146068
210	H.sapiens mRNA for orphan nuclear hormone receptor	84151
211	Sterol carrier protein 2	685578
212	Vitamin D (1,25-dihydroxyvitamin D3) receptor	364909
213	Sex hormone-binding globulin	82871
214	Basigin	244326
215	Cathepsin K Precursor	309733
216	Matrix metalloproteinase 1	589115
217	Matrix metalloproteinase 2	308493
218	Matrix metalloproteinase 2 (gelatinase A; collagenase type IV)	526335
219	Pregnancy-specific beta-1 glycoprotein 11 (MMP-11)	196828
220	Matrix metalloproteinase 12 (macrophage elastase)	138763
221	Matrix metalloproteinase 13 (collagenase 3)	300555
222	H.sapiens mRNA for MT-MMP protein (MMP-14)	270505
223	H.sapiens mRNA for putative MT4-MMP protein (MMP-17)	23715
224	MMP-18	1090083
225	MMP-19	756465
226	Homo sapiens clone rasi-1 matrix metalloproteinase RASI-1	120111

227	SPARC/osteonectin	122884
228	Tissue inhibitor of metalloproteinase 1	487256
229	Tissue inhibitor of metalloproteinase 2	133275
230	Metalloproteinase inhibitor 3 precursor	149564
231	Metalloproteinase inhibitor 3 precursor	326006
232	Plasminogen activator, tissue type (t-PA)	484846
233	Plasminogen activator inhibitor, type I	589458
234	Plasminogen activator inhibitor, type II (arginine-serpin)	194174
235	Plasminogen activator, urokinase	27734
236	Plasminogen activator, urokinase receptor	309454
237	Acid phosphatase 1, soluble	137358
238	Acid phosphatase type 5	774255
239	Adenylate cyclase activating polypeptide 1 (pituitary)	547784
240	Adenylate cyclase, Type II	967339
241	AXL receptor tyrosine kinase	31382
242	Calbindin (27-kD)	219956
243	Calbindin 2, (29kD, calretinin)	177266
244	Calcineurin A catalytic subunit	223296
245	Calcineurin B	38693
246	Human Snk interacting protein 2-28 mRNA	510613
247	Calgranulin A	346628
248	S100 calcium-binding protein A9 (calgranulin B)	115383
249	Calmodulin	159627
250	Casein kinase 1, alpha 1	469676
251	Casein kinase 1, delta	357667
252	Casein kinase 1, epsilon	166111
253	Casein kinase 2, alpha 1 polypeptide	417362
254	Human CSaids binding protein (CSBP1) mRNA	145531
255	Diacylglycerol kinase, alpha (80kD)	366944
256	Diacylglycerol kinase delta	112056
257	Diacylglycerol kinase, gamma (90kD)	277389
258	Extracellular signal-regulated kinase 1	356706
259	Extracellular signal-regulated kinase 3	27052
260	Homo sapiens ERK3 protein kinase mRNA	22568
261	FK506-binding protein 1 (12kD)	327648
262	Homo sapiens FK-506 binding protein (fkbp 12.6) gene	124255
263	Guanine nucleotide binding protein (G protein), alpha stimulating activity polypeptide 1	24286
264	Guanine nucleotide binding protein (G protein), alpha inhibiting activity polypeptide 2	195481
265	Guanine nucleotide binding protein (G protein), alpha inhibiting activity polypeptide 1	342254
266	Insulin receptor substrate-1	773110
267	Human integrin-linked kinase (ILK) mRNA	268171
268	Homo sapiens interleukin-1 receptor-associated kinase (IRAK) mRNA	587244
269	Tyrosine-protein kinase jak1	171569
270	JNK Activating kinase 1	31715
271	Stress-activated protein kinase JNK1	119133
272	Human protein kinase (JNK2) mRNA	233823
273	Human JNK3 alpha2 protein kinase (JNK3A2) mRNA	23173
274	Human kinase suppressor of ras-1 (KSR1) mRNA	668950
275	V-jun avian sarcoma virus 17 oncogene homolog	965499
276	Human c-jun proto oncogene (JUN)	502382
277	Jun B proto-oncogene	900300
278	Jun D proto-oncogene	796911
279	Human lipid-activated protein kinase PRK1 mRNA	186186
280	Human mad-related protein MADR1 mRNA	128882
281	Human mad protein homolog (hMAD-2) mRNA	700772
282	Human mad protein homolog (hMAD-3) mRNA	345935
283	Human chromosome 15 mad homolog Smad6 mRNA	429356
284	Human p38Beta MAP kinase mRNA	84148

285	MAP kinase-activated protein kinase 2	155628
286	Human MAPKAP kinase (3pK) mRNA	31782
287	Dual specificity mitogen-activated protein kinase kinase 1	115767
288	Dual specificity mitogen-activated protein kinase kinase 2	687712
289	Human MAP kinase kinase 6 (MKK Δ) mRNA	44727
290	Nuclear factor of kappa light polypeptide gene enhancer in B-cells 1	108800
291	Nuclear factor of kappa light polypeptide gene enhancer in B-cells 2	182473
292	Human I kappa B epsilon (Ikb δ) mRNA	36215
293	Human phosphodiesterase mRNA	647690
294	Phosphodiesterase 4B, cAMP-specific (dunce(Drosophila)-homolog phosphodiesterase E4)	346805
295	Phosphodiesterase 4C, cAMP-specific (dunce(Drosophila)-homolog phosphodiesterase E1)	926555
296	Phosphodiesterase 6G, cGMP-specific, rod, gamma	219858
297	Phospholipase A2, group IIA (platelets, synovial fluid)	152802
298	Phospholipase C, beta 2	726299
299	Phospholipase C, beta 4	668275
300	Phospholipase C, gamma 1 (formerly subtype 148)	362553
301	Phospholipase C, gamma 2 (phosphatidylinositol-specific)	701096
302	Human phospholipase c delta 1 mRNA	154600
303	Dual specificity mitogen-activated protein kinase kinase 3	207191
304	Protein kinase, cAMP-dependent, regulatory, type I, beta	469973
305	cAMP-dependent protein kinase regulatory subunit type I	545252
306	Protein kinase, cAMP-dependent, regulatory, type II, beta	162988
307	Protein kinase C, beta 1	50561
308	Protein kinase C, delta	428733
309	Protein kinase C, gamma	43516
310	Protein kinase C, iota	612904
311	Protein kinase C, mu	668368
312	Protein kinase C-theta	205239
313	Protein kinase C, zeta	23986
314	Protein kinase C substrate 80K-H	684946
315	Human putative protein kinase C inhibitor (PKCI-1) mRNA	327722
316	Protein phosphatase 1, catalytic subunit, alpha isoform	31988
317	Protein phosphatase 1, catalytic subunit, beta isoform	954377
318	Protein phosphatase 1, catalytic subunit, gamma isoform	29839
319	Protein phosphatase PP2A, 65 KD regulatory subunit, alpha isoform	714035
320	Protein phosphatase 2A, regulatory subunit b' alpha-1	154404
321	Protein phosphatase 2 (formerly 2A), regulatory subunit b" (PR72), alpha isoform	143397
322	Protein phosphatase 2 (formerly 2A), catalytic subunit, alpha isoform	43719
323	Protein phosphatase 2 (formerly 2A), regulatory subunit B (PR 52), alpha isoform	145196
324	Protein phosphatase 2 (formerly 2A), regulatory subunit A (PR 65), beta isoform	665685
325	Protein phosphatase 3 (formerly 2B), catalytic subunit, alpha isoform (calcineurin A alpha)	954826
326	Protein phosphatase 4 (formerly X), catalytic subunit	376394
327	Protein phosphatase 5, catalytic subunit	203539
328	RAB2, member RAS oncogene family	470432
329	RAB5B, member RAS oncogene family	649433
330	RAB6, member RAS oncogene family	35777
331	V-raf-1 murine leukemia viral oncogene homolog 1	47899
332	V-raf murine sarcoma viral oncogene homolog B1	417403
333	RAP1A, member of RAS oncogene family	562931
334	Ras homolog gene family, member G (rho G)	158086
335	GTPase-activating protein ras p21 (RASA)	201797
336	Neuroblastoma RAS viral (v-ras) oncogene homolog	151707
337	Human mRNA for p52 and p64 isoforms of N-Shc	133737
338	Human suppressor of cytokine signalling-1 (SOCS-1) mRNA	712481
339	Serum response factor (c-fos serum response element-binding transcription factor)	129049
340	Protein serine/threonine kinase stk2	345600
341	Signal transducer and activator of transcription 1-alpha/beta	512020
342	Signal transducer and activator of transcription 3 (acute-phase response factor)	548915

343	Signal transducer and activator of transcription 4	183407
344	Signal transducer and activator of transcription 5A	124672
345	Receptor protein-tyrosine kinase sky	343673
346	Protein-tyrosine kinase tyk2 (non-receptor)	236242
347	Tyrosine phosphatase 1	74678
348	Protein tyrosine phosphatase, non-receptor type 2	161909
349	Protein tyrosine phosphatase, non-receptor type 3	191708
350	Protein tyrosine phosphatase, non-receptor type 6	306509
351	Protein tyrosine phosphatase, non-receptor type 9	251574
352	Protein tyrosine phosphatase, non-receptor type 11	650696
353	Protein tyrosine phosphatase, non-receptor type 12	147519
354	Homo sapiens protein tyrosine phosphatase (CIP2)mRNA	700792
355	Protein tyrosine phosphatase, receptor type, alpha polypeptide	155661
356	Protein tyrosine phosphatase, receptor type, beta polypeptide	51041
357	Protein tyrosine phosphatase, receptor type, c polypeptide	46644
358	Protein tyrosine phosphatase, receptor type, delta polypeptide	341270
359	Protein tyrosine phosphatase, receptor type, gamma polypeptide	545088
360	Protein tyrosine phosphatase, receptor type, f polypeptide	45475
361	Protein tyrosine phosphatase, receptor-type, zeta polypeptide 1	50263
362	C-src tyrosine kinase	41587
363	Human transcription factor IL-4 Stat mRNA	267600
364	CAMP responsive element binding protein 1	110999
365	Human cAMP responsive element binding protein beta subunit	130280
366	CCAAT/enhancer binding protein (C/EBP), gamma	612403
367	Coup Transcription Factor	471889
368	ESTs, Highly similar to Coup Transcription Factor	33626
369	Homo sapiens epithelial-specific transcription factor ESE-1b	984308
370	Human ets domain protein ERF mRNA	415870
371	Human Ets transcription factor (NERF-2)	26130
372	Ets variant gene 4 (E1A enhancer-binding protein, E1AF)	430297
373	Ets variant gene 6 (TEL oncogene)	111961
374	ELK1, member of ETS oncogene family	309323
375	ELK4, ETS-domain protein (SRF accessory protein 1)	1011489
376	Transcription factor Eryf1	109093
377	GATA-binding protein 2	309878
378	Human transcription factor hGATA-6	301258
379	Msh (Drosophila) homeo box homolog 1	346277
380	V-myc avian myeloblastosis viral oncogene homolog-like 2	377537
381	Human octamer binding transcription factor 1	279438
382	Human paired box gene (PAX6) homologue	220373
383	H.sapiens Pax8 mRNA	686498
384	POU domain, class 2, transcription factor 1	192694
385	POU homeobox protein	37087
386	Transcription factor RELB	52681
387	Transcription factor P65	284536
388	Human mRNA for transcriptional activator hSNF2b	685408
389	Wilms tumor 1	470470
390	V-myc avian myelocytomatosis viral oncogene homolog	153468
391	Lysyl hydroxylase	153530
392	MAX protein	116359
393	Transcription factor COUP 2 (a.k.a. ARP1)	38163
394	Breast cancer 1, early onset	843077
395	Breat cancer 2, early onset	711698
396	Human Bc12, p53 binding protein Bbp/53BP2	161470
397	Deleted in colorectal carcinoma	548047
398	Mouse double minute 2, human homolog of; p53-binding protein	148052
399	Neogenin (chicken) homolog 1	188380
400	V-rel avian reticuloendotheliosis viral oncogene homolog	704548

401	Human putative tumor suppressor (SNC6)	25655
402	Tumor protein p53 (Li-Fraumeni syndrome)	236338
403	Actin, beta	343019
404	Deleted in azoospermia	565112
405	Human EB1 mRNA	564023
406	ESTs, moderately similar to hypothetical protein H19	486827
407	Apolipoprotein CI	235202
408	Very low density lipoprotein receptor	340727
409	ESTs, highly similar to TESTIN 2 PRECURSOR	119344
410	Sulfated glycoprotein 1	342880
411	Ribosomal protein, large, P1	566909
412	TNF	682639
413	TRAIL	740559
414	TRDL	724679
415	TRDL2	129696
416	TRDL3	936927
417	Lymphotoxin-B	345232
418	TRANCE	825287
419	TNF-R1	126751
420	TNF-R2	71046
421	FAS	470405
422	DR-3	175727
423	DR-4	526788
424	DR-5	788185
425	DCR-1	504745
426	OPG	325973
427	TRADD	1089784
428	FADD, Mort-1	446232
429	RIP	592125
430	Flame-1, Casper, MRIT	588320
431	caspase-1	529323
432	caspase-3	429574
433	caspase-4	341417
434	caspase-5	341763
435	caspase-6	323500
436	caspase-7	563750
437	caspase-8	527087
438	caspase-9	491534
439	caspase-10	121409
440	casper	511600
441	bcl-2	285534
442	bcl-xl	298187
443	bax	388733
444	bad	746273
445	bik	685783
446	possible bax homolog	1074662
447	bcl-w	984714
448	hrk	767779
449	p21	809506
450	mdm2	682817
451	mdmx	809393
452	gadd45	898682
453	gadd45-2	760180
454	gadd45-3	1029305
455	c-myc	1057750
456	Hic	343187
457	galectin-7	342088
458	guanidinoacetate N-methyl	826138

459	Quinone oxidoreductase homo	1086151
460	Serum Amyloid A	1056803
461	Normal Keratinocyte mRNA	757035
462	Proline oxidase homo	345158
463	TNF-a induced mRNA	264567
464	Etoposide induced mRNA	1013458
465	Tax-1 binding protein	51768
466	Actin-binding protein	267089
467	unknown	154444
468	Micro glutathione trans	984498
469	nmyc	1031203
470	parc	491464
471	GAPDH	725484
472	Mucin	1147701
473	22 kDa Smooth Protein	914301
474	mammoglobin	964748
475	p27(the other one)	1013571
476	IP-10	967284
477	PAFAH 1B	781462
478	PAF Receptor	686435
479	Endothelial-Monocyte Activation Polypeptide II	739276
480	RAP1 GTPase Activating Protein 1	588447
481	5-Lipoxygenase Activating Protein	594108
482	ADP-Ribosylation Factor-1-Directed GTPase Activating Protein	683158
483	PECAM-1	589246
484	Cytokine Receptor Class-II CRF2-4#011#	626429
485	Cytokine Receptor Precursor	753869
486	Cytokine Receptor Common Gamma Chain Precursor	510700
487	Cytokine Type1 Receptor	768376
488	Cytokine Type 1 Receptor: Incomplete IL-II Receptor Isoform	811920
489	MIP-1a Precursor	1058644
490	Psoriasis	1088345
491	MIP-22 Precursor	1015315
492	Calgranulin A	1089513
493	MCP-1 Precursor	1072789
494	Placental Thrombin inhibitor	916778
495	Myosin Regulatory Light Chain 2 smooth muscle isoform	1042286
496	Macrophage migration inhibitory factor	1298002
497	Placental Bone Morphogenic Factor or Prostate Differentiation Factor	1059641
498	Insulin Receptor Substrate-1-Like Protein	1099538
499	MIP-1B- CC Chemokine-1	999421
500	Stat-Induced Stat Inhibitor-2	383288
501	Interleukin II Receptor Isoform	1056339
502	Growth/Differentiation Factor GDF-7	1061011
503	Map K P38	1057458
504	Human Mitochondrial Processing Peptidase a Subunit	1086816
505	Caspase 11/12 ???? 1ch-2 Protease#011#	1028828
506	IL-10 Precursor	914603
507	Lymphocyte Chemotactic factor IL-16	914945
508	IL-4 Receptor Alpha Chain	1088358
509	Interleukin Enhancing Binding Factor 2	1086516
510	CCAAT/Enhancer Binding Protein B	1075913
511	Natural Killer Cell Protein-4#011#(IL-1 Receptor-Associated Kinase P -6)	1017126
512	Protein Phosphatase PP2A-Beta Catalytic Subunit	1090211
513	MCSF - a(CSF-1)#011#	1101339
514	CREB-Binding Protein	1015670
515	IL-2 Receptor Alpha Chain	1086498
516	I-Kappa B Epsilon (Bone-derived growth factor)	1058403

517	Poss. IL-1 Receptor-Assoc Kinase	1074163
518	IL-1B	1075382
519	Phosphorylase B Kinase a catalytic Shain	1058707
520	IL-1 Beta Convertase	120106
521	IL-8 Precursor	446097
522	Mus Adhesion-Related Kinase P -5	1097836
523	ADP-Ribosylation Factor 6	1013285
524	Notch 4/IL-1 Signal Transducer	1076343
525	IL-12 Receptor Component	1075251
526	Vitelline Outer Membrane Protein N-CoR (mus)	1085468
527	Peptidyl-Proy-Xis-Trans Isomerase	999171
528	IL-8 Receptor B	993703
529	IL-II Precursor	1018040
530	YST sds22 Homolog (Protein Phosphatase Regulatory subunit)	1056461
531	IL-1 Receptor, Type 1	985186
532	IL-6 Receptor	1062736
533	IL-4 Receptor Alpha Chain	1087456
534	IL-1Ra	1076004
535	LFA-1 (CR-3)	1117220
536	ICAM-3	1029612
537	CD44	985292
538	Cell Adhesion Regulatory Protein	90998
539	Intergrin Alpha-E (CD11c/Alpha x)	1071538
540	ICAM-2	1113116
541	S-Laminin(Beta2)	1000924
542	Cell Adhesion molecule (Opiold Binding protein)	986334
543	LaminIn Beta-1 Chain	1090694
544	Human Cell Adhesion Protein (SQM1) (HE4)	1074681
545	Dishevelled 3	1073913
546	TNF Alpha Inducible Protein TS6-6	1043312
547	Hyloronlases	1088078
548	MAP Kinase Phgosphatasey	1101698
549	Laminin Alpha-4 Chain	1129065
550	ICAM-1	1241583
551	ICAM-1	1241583
552	011	
553	PECAM	1264506
554	Annexin VII	1215156
555	LFA-1 (CR-3)	1255690
556	P-selectin	1071755
557	C4 Binding Protein (C4BP)	1013367
558	Na/K ATpose Beta-3 Subunit	1089164
559	N-Terminal Acetyltransferase	1090171
560	Cell Adhesion Protein	1031559
561	P150,95 alpha chain	1087611
562	Guanine Nucleotide Binding Protein Gi/slt Beta Subunit	1117461
563	Insulin-like Growth factor II	1018322
564	Insulin-like Growth factor 1a	915645
565	Heparin-binding growth factor precursor 2	1057968
566	Insulin-like Growth factor binding protein 6	1046063
567	Insulin-Lia Growth Factor II Associated	1018766
568	Transforming Growth Factor Beta 3	914964
569	Pleiotrophin (NGF)	994850
570	PDGF, A chain	1028836
571	TGF-Beta 1	1087877
572	Connective Tissue Growth Factor	1112545
573	Connective Tissue Growth Factor Neighbor	1113071
574	UNK (P -6 MEAA clycoprotein 4/ insulin like growth factor complex acid	

575	IAB1E subunit	1146577
576	TGF-1Beta Binding Protein	1102972
577	Fibrillin-1	1145014
578	ERB2 Receptor Protein Tyrosine Kinase (Noe Protonca)	1146373
579	UNK- LTK Kinase-like/HGF-like	1134209
580	Growth Arrest/DNA damage-inducible protein	1031696
581	Granulins Precursor	1104449
582	PD-ECGF (thymidine Phosphorylase	1102234
583	TNF-R2	782059
584	TNF	682639
585	TNF-R2-Related Protein	1009147
586	TNF-R1	796016
587	TNF-T1-Associated Protein	503351
588	GAPDH (Liver)	724086
589	G-Protein-Coupled Receptor ROC-1 Homolog	43181
590	OSR BGTC Receptor ??-1 neighbor AA234544 zs 39eo951 ?	687592
591	OSR-R Beta Precursor U 60805???????	60805
592	Zc 79d02.r1	328515
593	P 65 5	700932
594	P105 5	683232
595	PI3 Kinase Catalytic subunit	48772
596	C-Rel	704548
597	Eotaxin	488534
598	BTG-1 (B-cell translocation gene	1113893
599	TGF-B Induced protein/transcription factor	1146571
600	Calcyclin	1133547
601	Ubiquitin	1129496
602	14-3-3 Protein Beta	1048618
603	Micrasomal Dipeptidase	1030799
604	Translationally Controlled tumor protein/1gE- Depreslant histormire releasing	
605	homolog	951450
606	Adrenal Specific 30KDa Protein(preadipocyte factor	1116675
607	Gadd 153	1129319
608	Bone Morphagenic Protein 2	743521
609	LYSY1 Hydroxylase	1112518
610	HBRM/Possible Global Transcription Activator SNF2L2	1146549
611	Insulin-like Growth factor -5	1112692
612	Clusterin Receptor	1113417
613	Endoglin	1145493
614	IL-6 Receptor-Alpha#011#	754500
615	Ciliary Neurotrophic Factor Receptor K	156431
616	Epidermak Gr Factor Receptor	137017
617	Fibroblast Growth Factor Receptor	1016926
618	FMLP- Related Receptor 1	126313
619	Granulocyte-Macrophage Colony	289337
620	Granulocyte Macrophage Colony Receptor a	80239
621	IL-8 REceptor	882183
622	CCR 1	298977
623	VCAM-1	1009036
624	Cd-18	704517
625	IL-1Receptor-Associated Linase	994873
626	HCF-1 gene related	116378
627	G5-Alpha	994229
628	PYK2 (FAK)	941542
629	N-Cam-PI linked	76658
630	FAK	1015672
631	MAC-1 alpha subunit	754406
632	ICAM-3	925820

633	ALCAM (activated leukocyte adhesion mol)	686180
634	Neuronal Cell Adhesion Md. (CALL)	930183
635	TNF-Alpha inducible Pr. 6	376485
636	telencephalin (ICAM-5)	180864
637	CD 11c	684777
638	CD11a	684375
639	CD44	565937
640	Cellular Adhesion Regulatory Molecule	964447
641	L-Selectin	149910
642	ICAM-2	342721
643	CD18	342721
644	Megakaryocyte-Assoc. TYR Kinase	547332
645	FcR III (CD16)	429294
646	Kangai-1 (CD 82)	548957
647	Protein Tyrosine Phosphatase Receptor type Alpha Polypeptide	686356
648	CD45	1061766
649	Protein Tyrosine Phosphatase, Receptor type, alpha polypeptide	207782
650	CD37	824359
651	CD47	927618
652	CD 53	137716
653	Leukocyte SG Kinase-90KPA	926344
654	Ribosomal SG Kinase-90 KPA	926344
655	Ribosomal SG Kinase	152051
656	Ankyrin	840683
657	Gro-beta	841361
658	CNTF Receptor Alpha	470012
659	SDF-1	181834
660	Cytokine common Gamma Subunit	244355
661	iNOS	238832
662	Polyadenylate binding protein	30982
663	mitogen-inducible gene-2 (nig-2)	214219
664	Putative enterocyte differentiation promoting factor	530098
665	Inducible Protein	471099
666	Midkine (neurite growth promoting factor-2)	1013917
667	TGF-Beta Inducible Early Protein	1011500
668	TNF-Alpha Inducible protein A20	712391
669	Lactotransferrin	160270
670	P20teinase 3	198245
671	Defensin 1,2,3 precursor	503651
672	p40 Oxidase subunit	811001
673	Desmosome Assoc Protein	122505
674	Highly Similar Neutrophil cytokine factor 2	361712
675	Cytochrome B245 Alpha Polypeptide	712465
676	Neutrophil Gelatinase Associated lipocalin R	882040
677	Acyloxyacyl Hydrolase (neutrophil)	90033
678	Tonsillar Lymphocyte LD78 Beta PR	15533
679	9G8 Splicing factor mRNA	714123
680	Galectin-3	1012680
681	Integrin Alpha-2	687871
682	Density-Enhanced Phosphatase-1	487115
683	TIMP-1	771755
684	CDC16 H5	588109
685	MMP 12	138763
686	Secretory granule Proteoglycan core	310779
687	Vimentin	979539
688	Sialyltransferase 1	361246
689	Macrophage Stimulating Protein Receptor	936630
690	T-Cell lymphoma Invasion & Metastasis-1	550069

691	N RAMP-2	112883
692	JNK-2	684856
693	Similar Clathrin Coat Assembly Protein	563697
694	2 G s Protase Regulatory subunit	563697
695	DNA J Homolog	926319
696	Actin 1	1007593
697	Weakly Similar Trans-Activating transcriptional	503183
698	Moderately Similar WW-binding protein	998681
699	Weak Sim No definition line form	993615
700	PI Synthase	993664
701	D2x4 Puringrgig Receptor	129015
702	Weak Sign P 52-KD actoantiger	587079
703	Weak Sign sKm-BOP2	429117
704	Cannabinoin Receptor-2	683442
705	Migration Macrophage Inhibitory factor	937457
706	MG Sod	1015609
707	rho G	503510
708	MRNA for RTP	363583
709	CSF-1	682601
710	Manase Receptor	196684
711	40S Ribosomal Protein 40	979566
712	BTG2	967880
713	Gelatinase A	994545
714	Pasminggen Activator inhibitor-2	470932
715	Thyrosin-beta 4	1014394
716	Macrophage stimulating 1 (HGF-Like)	109541
717	Thyrosin Beta-10	745835
718	CD63	965758
719	Cathepsin H	232359
720	Proteosome Beta Chain	489155
721	BT G-1 Auto-Proliferative	469919
722	CDC 42	471765
723	Annexin V	362081
724	Macrophase Scavancer Receptor I IV	979480
725	Mono to Mac Differentiation	686617
726	P62 (Glycine-Rich Protein)	563796
727	CD69	68105
728	Capping Protein (Gessulin-LInk)	979289
729	M/CSF	755654
730	Metallothinine-2	979597
731	Interferon regulatory protein 2	686605
732	AMP Deamidase-3	470535
733	Cathepsin B	364020
734	GTP Cyclohydralase	565876
735	Oligosacemtitransferase	1016028
736	Calgranulin B	115383
737	Depth domain containing protein cradd	700353
738	MCP-4	758321
739	MCP-1	503192
740	MCP-3	485989
741	CD14	181908
742	Kynurenine Hydrolase	824253
743	Urokinase plasminogen actiuator receptor-GPI Linked	725227
744	GRO1 Oncogene	323238
745	GR02 Oncogene	153340
746	H.sapiens Humig mRNA	503617
747	Interleukin 8	326092
748	Interferon (gamma)-induced cell line; protein 10	491243

749	NCXC-1	753794
750	LIX	343403
751	PPBP	198786
752	Platelet factor 4	588448
753	Stromal cell-derived factor 1	211268
754	Neurotectin	180786
755	SCYA2	251226
756	SCY A3	346550
757	SCYA4	205633
758	SCYA5	771182
759	SCYA6	111248
760	SCYA7	322873
761	SCYA11	502658
762	SCYA 13	80146
763	SCYA14	195485
764	SCYA 15/SCYA16	77539
765	SCYA18	470492
766	SCYA19	121481
767	SCYA21	503192
768	Chemokine (C-C) receptor 1	298977
769	Chemokine (C-C) receptor 5	701290
770	Chemokine (C-C) receptor 7	182764
771	Human CC-chemokine receptor 10 (CCR10) mRNA	149079
772	Interleukin 8 receptor, beta	882183
773	Human monocyte chemoattractant protein 1 receptor	204539

List of salaried personnel

<u>Name:</u>	<u>Position:</u>	<u>Percent contribution to salary:</u>
Ray White, Ph.D.	P.I., Professor	6%
Hans M. Albertsen, Ph.D.	Research Instructor	33%
Chris Anderson	Sr. Research Specialist	100%
Hoyt Heaton	Lab Technician	100%